Humanity United Now – Ana Maria Mihalcea, MD, PhD cross-posted a post from OUTRAGED's Newsletter

Ana Maria Mihalcea, MD, PhDJul 7 · Humanity United Now – Ana Maria Mihalcea, MD, PhD

I could not agree more. Next week on my show I will interview WHO and World Bank Insider Peter Koenig. He will tell you ho   nity. I
article, so you understand what already has happened – effectively implementing digital ID through the back door without you   on na

AGENDA 2030 IS ABOUT NANOTECHNOLOGY AND   IN

OUTRAGED HUMAN
JUL 7

UK Events 2024

The Alternative View Presents Thomas Sheridan

Date: 20 October 2024
Time: 10:00 AM - 4:15 PM
Location: The Assembly Rooms, High Street, Glastonbury, BA6 9DU
More info

The Magical Landscapes of these Sacred Islands

Sutton

on Vallance and the whack-a-mole of mass murder

on The Best Election Ever.

on The Best Election Ever.

Links and Ads

Ecommerce-Help

THE 2030 AGENDA

IS BASED MAINLY

ON TOXIC NANOTECHNOLOGY!!!

https://addi.ehu.es/bitstream/handle/10810/43990/s41467-020-16297-3.pdf%3Bjsessionid%3DAEE6C9AC6FF000AC65799DCE95533874?sequence=1

challenges. We discuss the roles of targeting solutions, technology translation, the circular economy, and a number of examples from national efforts around the world in reaching these goals. We have formed a network of leading nanocenters to address these challenges globally and seek to recruit others to join us.

Figure 1. Current urgent problems caused by environmental and social stressors addressed by the United Nations' Sustainable Develop
Goals.[4]

https://doi.org/10.1021/acsnano.1c
ACS Nano 2021, 15, 18608–

Why Nano? Instead of incremental improv
existing technologies, nanotechnology offers disrup
changing breakthroughs and innovations that c
immediate answers and solutions to help ou
environment, and the planet (see Figure 2). Area
nanotechnology advances are making differenc
energy, environmental protection, resource manag
healthcare through the development of smart ma
connected devices. Further, nanoscience and nano
as fields, have developed communication skills to bring
scientific, engineering, medical, and other communities
together, and have thus impacted many related fields.[7]

THE HOLY GRAIL

584069724426078

or

58407

Download https://thelawoffrequencies.com

Rife and The Law of Frequencies video presentation

Atom Feed

WORKING TOGETHER, MULTISECTORIAL APPROACH CRITICAL FOR MEANINGFUL IMPACT FOR SOCIETY

We are already seeing the impact of these governmental investments now and will continue to do so in the coming years. A prominent example is the way mRNA vaccines for COVID-19 are delivered through lipid nanoparticles, which is indeed a game changer, and is based on decades of fundamental research in nanoscience and nanotechnology.[12,13]

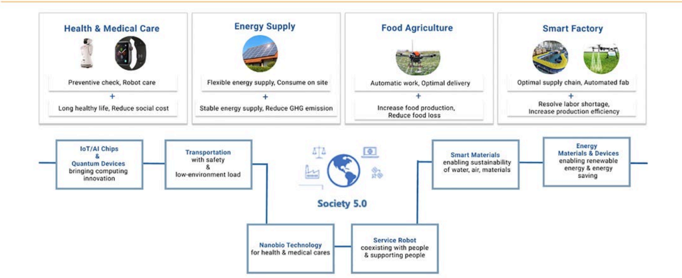


Figure 4. Examples of new values created in various fields[14] and grand challenges for nanotechnology and materials to support Society 5.0. IoT, Internet-of-Things; AI, artificial intelligence.

(b)

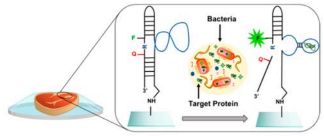


Figure 10. (a) Real-time biosensors wrapped in film containing sensors for real-time monitoring. (b) Illustration of DNAzyme sensors cleaving target in the presence of *E. coli* cells.[51] Reproduced from ref 51. Copyright 2018 American Chemical Society.

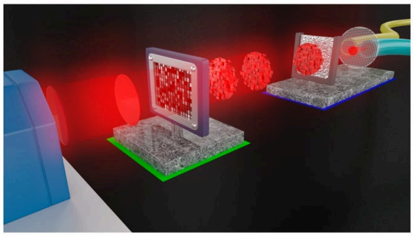


Figure 11. Spatial light modulator creating a few-photon wavefront focusing on a detector to encrypt private messages for asymmetric cryptography. Reprinted with permission from ref 53. Copyright 2019 Institute of Physics Publishing Ltd.

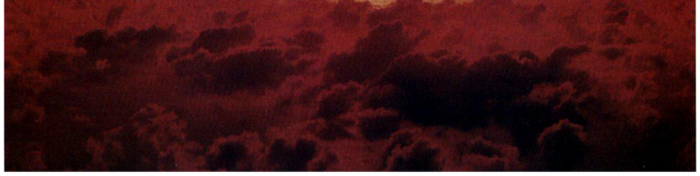
…

CRYPTOGRAPHY = CBDC

FINAL THOUGHTS

Yuval Noah Harari, in his book *Sapiens: A Brief History of Humankind*, emphasizes that we as "humankind" are a minority on the planet. However, through our collective intelligence and ability to work collaboratively, we have emerged as the dominant species on earth.[83] Therefore, we have a tremendous responsibility to pass along this amazing ecosystem to future generations. Nanotechnology, a cutting-edge technology of the 21st century will enable us to target and to achieve this unified vision of a sustainable planet for all.

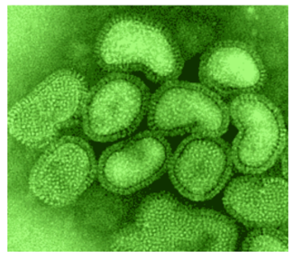
THAT'S WHAT THESE "INJECTIONS" AND "PANDEMICS"ARE ALL ABO
THEY ARE AIMED AT INJECTING, INSTILLING, INHALING, INGESTIN



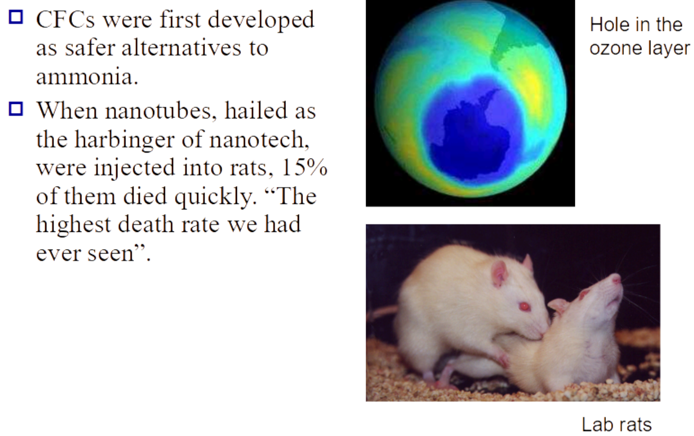
Problem: The Potential Threats of Nanotechnology

- As with all new technology, we should evaluate nanotechnology not only on its potential gains, but also on its potential threats.
- Some of these fall into the following categories:
  - Biological
  - Environmental
  - Military
  - Other

Nightmare “Gray Goo” scenario



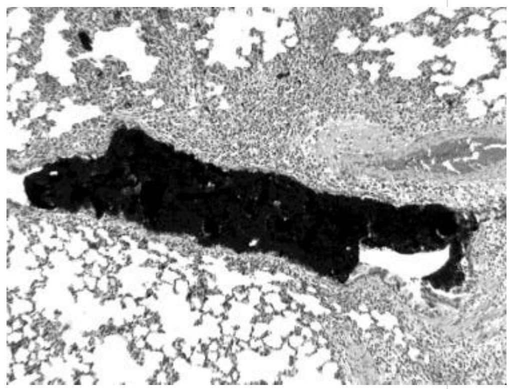
cells in a petri dish



When nanotubes, hailed as the harbinger of nanotech, were injected into rats, 15% of them quickly. "The highest death rate we had ever seen".

https://web.archive.org/web/20100619234814/http://www.che.tamu.edu/orgs/groups/Seminario/nanotechnology/PLong_G4_Nanotoxicology_Diego_Gomez.ppt

Rats that were instilled with high doses of SWCNT's died of respiratory blockag rather than pulmonary intoxication



The picture shows that the respiratory airways are mechanically blocked by carbon nanotubes. This led to the asphyxiation of 15% of the test population

Results

Asphyxia

Condition of severely deficient supply of oxygen to the body

https://www.ncbi.nlm.nih.gov › pmc › articles › PMC9968210

Fatal Asphyxia Potentially Caused by COVID-19-Induced Exacerbatio...

Jan 26, 2023 · The patient had **COVID**-19, which was presumed to have aggravated the existing tracheal stenosis and caused **asphyxiation**. The patient died seven days later. This is, to our knowledge, the first report of a patient with subglottic stenosis potentially aggravated by **COVID**-19,...

Asphyxia causes generalized hypoxia, which affects all the tissues and organs, some more r than others.

Silent hypoxemia is common in patients with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. In this article, the possible pathophysiological mechanisms underlying respiratory symptoms have been reviewed, and the presence of hypoxemia without **hypoxia** is also discussed. Th...

https://journals.lww.com › em-news › Fulltext › 2022 › 01000 › InFocus__Treating_Hypoxia_in_...

InFocus: Treating Hypoxia in Discharged COVID-19 Patients : Emerge...

Silent **hypoxia** occurs in 20-40 percent of **COVID** patients with pulmonary involvement. The authors of this report describe a few impossible-to-understand reasons behind silent **hypoxia** in **COVID**-19. The authors speculate that the virus may affect the brain and nervous system or a lack of normally occurri...

https://www.mayoclinicproceedings.org › article › S0025-6196(21)00043-4 › fulltext

Does Hypoxia Itself Beget Worsening Hypoxemia in COVID-19?

Coronavirus disease 2019 (**COVID**-19) infection has been linked to a broad range of organ involvement including lungs, heart and blood vessels, and gastrointestinal tract. 1 The most common presentation has been of viral pneumonia, characterized by progressive **hypoxia**, often in the absence of appropria...

https://www.ncbi.nlm.nih.gov › pmc › articles › PMC8897613

Causes of Hypoxemia in COVID-19 - PMC - National Center for ...

It has been repeatedly shown in numerous studies that **hypoxia** progression in **COVID**-19 patients at the early stage of the disease occurs at the normal PaCO 2 level (normocapnia), which does not appear to be a sign of respiratory dysregulation [22, 23, 35]. However, **hypoxia** is known to cause...

https://www.ncbi.nlm.nih.gov › pmc › articles › PMC8897613

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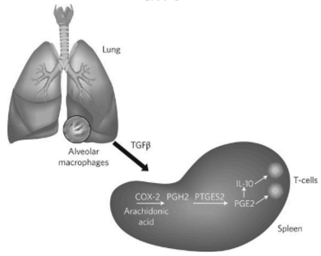
https://journal.chestnet.org › article › S0012-3692(21)04683-3 › fulltext

Silent Hypoxia in Covid-19: Is It More Dangerous? a ... - Chest

RESULTS: Among 2080 patients with **COVID**-19 admitted to our hospital, 811 patients were hypoxic with SpO 2 <94% at the time of presentation. Out of 811 patients,174 (21.45%) did not have complaints of shortness of breath since the onset of **COVID**-19 symptoms. 5.2% of patients were completely...

Immune-suppression

Mechanism for Immune-suppression by CNT's



Methods

- Air contaminated with low concentration CNT's
- Exposure 6h per day during 14 days
- Tracking of proteins and immune response

Results

Immune-suppression

A signal, likely TGFβ, is released when the carbon nanotube is inhaled. This was tested by isolating the BALF protein from both exposed and control rats. It was shown that the protein from exposed mice cause immune-suppression

Nature nanotechnology (2009) , Vol. 4, pp 451

CARBON NANOTUBES IN MASKS:

https://www.ncbi.nlm.nih.gov › pmc › articles › PMC8106907

Developments in Nano-materials and Analysing its role in Fighting C...

Abstract. Nanomaterials like silver, iron, ceramic, graphene **carbon nanotubes**, etc. These are used to develop and create multifunctional materials to fight the corona virus. This work focuses on analyzing and discussing the developments of Nano-materials and their effectiveness in fighting and preventing...

https://pubs.acs.org › doi › 10.1021 › acsnano.1c00629

Carbon-Based Nanomaterials: Promising Antiviral Agents to Combat ...

Antiviral Face **Mask** Functionalized with Solidified Hand Soap: Low-Cost Infection Prevention Clothing against Enveloped Viruses Such as SARS-CoV-2. ACS Omega 2021, 6 ... Coronavirus and **Carbon Nanotubes**: Seeking Immunological Relationships to Discover Immunotherapeutic Possibilities....

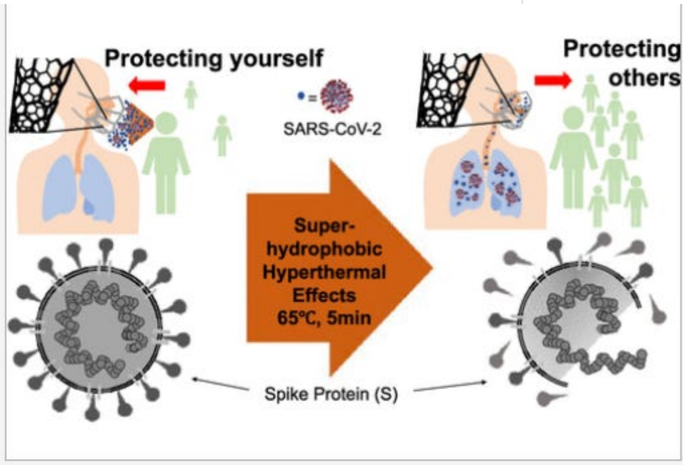
https://www.sciencedirect.com › science › article › pii › S0008622323002993

Nanotechnology in the COVID-19 era: Carbon-based nanomaterials a...

Jun 15, 2023 · Besides fullerenes, the sp2 **carbon** atoms can also form single-walled **carbon nanotubes** (SWCNTs) and multiple-walled **carbon nanotubes** (MWCNTs) where each "wall" is a single graphene sheet rolled up into a nanocylinder. The length of CNTs is in the micrometers range with a diameter...

https://www.sciencedirect.com/science/article/pii/S2215038221001849 Carbon nanotubes in COVID-19: A critical review and prospects – ScienceDirect

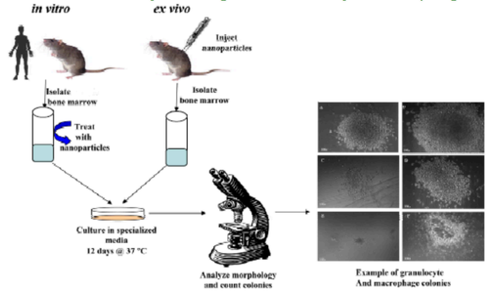
The nanocarbon filter functions as a superior barrier compared to those in conventional masks owing to the stronger, more uniform, and more durable hydrophobic nature of the carbon nanotubes. A tightly knit carbon nanotube network has a pore size smaller than that of the average coronavirus; nevertheless, the breathability is equal to that of the conventional polypropylene filter. The exceptional thermal conductivity of carbon nanotubes transpires hyperthermic antiviral effects, which offers stronger protection against the virus, as well as reusability. The facile processability, low cost, and light weight of the aerosol-synthesized carbon nanotube filter warrants its viability, reinforcing the fight against the COVID-19 pandemic.



Consequence: Modified Tests Developed

➢Nanoparticle medical treatment poses the risk of nanoparticle agglomeration

Schematics of Colony Forming Unit Granulocyte-Macrophage Test



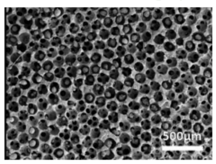
The test is conducted is conducted both in in vitro and ex vivo conditions, the results are analyzed and give outputs as the images at the right

Nature nanotechnology (2009) , Vol. 4, pp 411

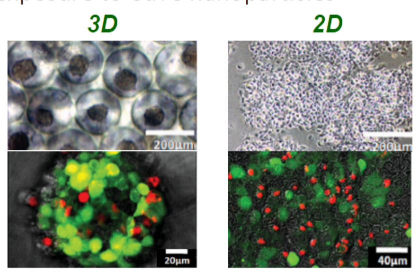
3D vs. 2D assays: Quantum Dot Toxicity

➢Quantum dot toxicity in liver cells was lower when measured using the 3D scaffold technique, as determined by the cell death rate after exposure to CdTe nanoparticles

3D scaffold micrograph



Results in 3D culture correlate much better to animal in vivo studies

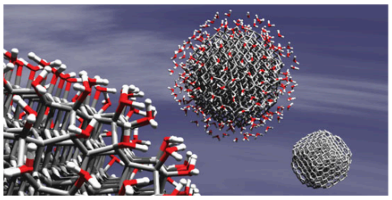


Dead cells are identified with red color after a staining assay. Despite some cell death in the spheroid surface, the death rate is much higher in the 2D tissue

Small 2009, 5, pp 1213-1221

chemical interactions with gases, liquids and other nanoparticles surrounding them. This can be studied using molecular simulations

Interaction of Water Molecules with NP



Recent Example Studies

- ***Surface reactivity of ferrihydride NP assembled in ferritin (and iron storage protein)***
- ***Nanotoxicological implications of oxygen adsorption at silver surfaces***

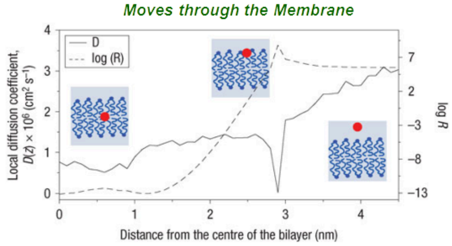
The specific and quantitative knowledge obtained from theory and simulation can help building predictive models and algorithms for assessing the likelihood of toxicity in various natural environments

Nature nanotechnology (2009) , Vol. 4, pp 332

Fullerene Disruption of Cell Membranes

➢Some studies has suggested the penetration of fullerenes aggregates through cells, and blood and brain barriers. However, the mechanism is poorly understood

Diffusion Coefficient of Fullerene as It Moves through the Membrane



The results reveal a higher permeability of fullerene through the lipid bilayer is higher than water but lower than hydrocarbon molecules

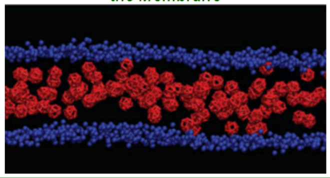
Proposed Toxic Mechanisms

- *Membrane Damage*
- *Disruption of Membrane Elastic Properties*
- *Chemical Interaction*

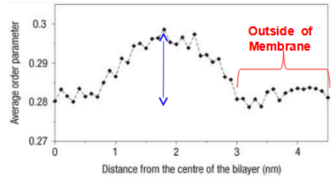
Nature nanotechnology (2008) , Vol. 3, pp 363

barely affect the structure of lipid bilayer

Snapshot of Fullerene Positions Inside the Membrane



Change in the Order Parameter at Different Positions of the Fullerenes



Fullerene and fullerene aggregate are kinetically and thermodynamically favored to locate near the center of the membrane

The mechanism of cell disruption due to mechanistic damage of the cell membrane by the fullerene is discarded

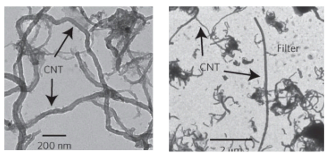
Possible mechanism of disruption of cell function is through the change of elastic properties of the membrane

Nature nanotechnology (2008) , Vol. 3, pp 363

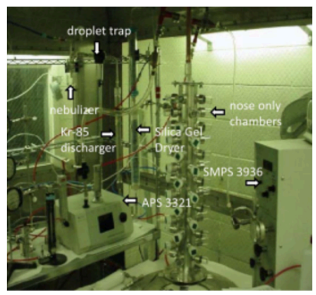
CNT Disruption of Pleural Tissue

➢Due to similarities with asbestos fibers, carbon nanotubes toxicity is usually related to pulmonary illnesses

Before and After Aerolization TEM image of MWCNT's



Setup for aerolization of MWCNT's



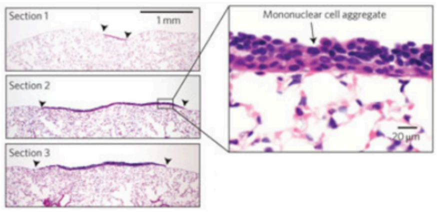
MWCNT's are aerolized as mice inhale the aerosol to reproduce doses of 0.2 – 4 mg (MWCNT)/kg (mice)

The exposure time was 6h, and the subsequent retrieval of pulmonary tissue was made after 1 day, 2 weeks, 6 weeks and 14 weeks

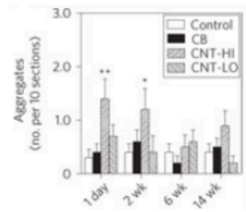
Nature nanotechnology (2009) , Vol. 4, pp 747

➢The immune response to the presence of the nanotubes was evaluated by counting the number of mononuclear cell aggregates (macrophages, lymphocytes, etc)

Different Transversal Sections of Lung Tissue



Aggregate Counts



There is a correlation between the number of aggregate counts and the dosage of carbon nanotube to the mice. Also, it is seen that carbon black (CB) does not trigger as a strong response as CNT's

Nature nanotechnology (2009), Vol. 4, pp 747

CNT Disruption of Pleural Tissue

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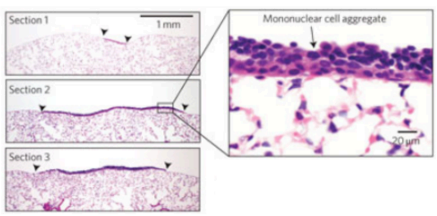

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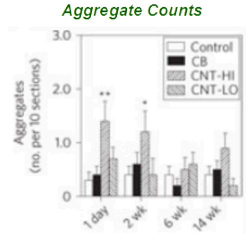

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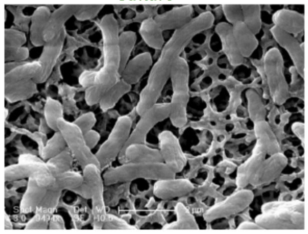
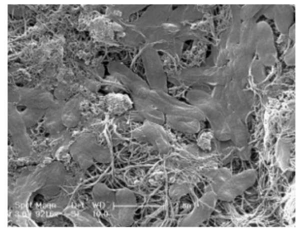
Nature nanotechnology (2009), Vol. 4, pp 747

nanotubes

SEM image of a normal E. Coli Culture



SEM image of a E. Coli Culture with SWCNT's



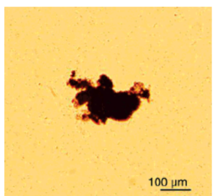
The carbon nanotubes were grown using a cobalt-containing catalyst on a silica support . The nanotubes were washed and stripped of metal traces and used for the culture. Staining assays are able to tell the live cells from the dead cells

Langmuir (2007) , Vol. 23, pp 8671

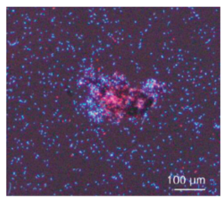
Carbon Nanotubes: Germ Killers

➢ Staining assays reveals the high percentage of dead cells due to the presence of carbon nanotubes

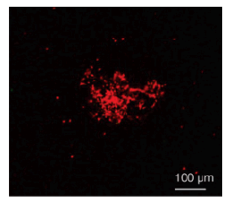
Carbon Nanotube Patch



Fluorescent Image of Culture



PI Stained Dead Cells

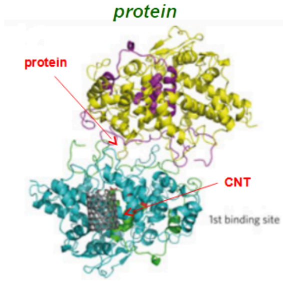


It is apparent the correlation of the location of the nanotube in the culture and the location of dead cells. Comparison of the fluorescent images for the totality of the cells and the ones dead shows a very high rate of mortality, which was determined to be around 80 %

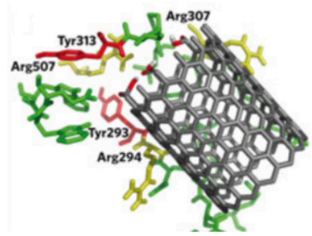
Langmuir (2007) , Vol. 23, pp 8671

biodegradation mechanism of hMPO on the nanotube.

Attachment of CNT to the protein



Residual Groups Attacking the Nanotube



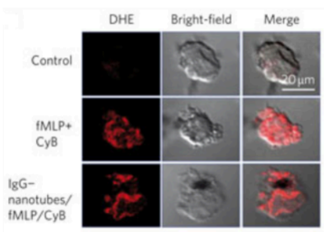
A site-localized reaction in which hMPO positive charges favor the binding of nanotubes and radical-supporting aromatic groups participate in the cleavage of the nanotubes

Nature nanotechnology (2010) April -Advanced Online Publication

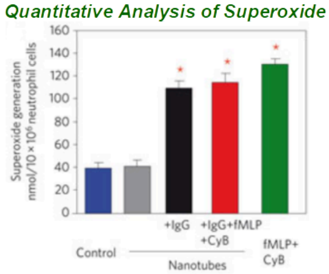
Biodegradation of CNT's and Toxicity

➢ The likelihood of CNT's biodegradation in intracellular hMPO is evaluated. CNT's are injected in cells and the oxidative activity within the cells is tracked

Superoxide Mapping



Quantitative Analysis of Superoxide

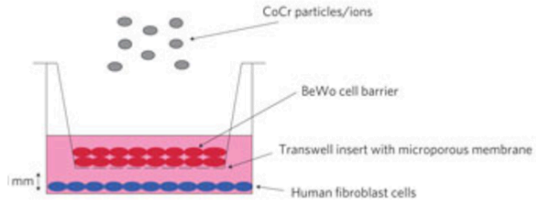


The functionalization of carbon nanotubes increased the intracellular superoxide activity, as well as the release of hMPO and peroxide.

Nature nanotechnology (2010) April -Advanced Online Publication

raised concerns over their ability to reach privileged sites in the body. CoCr NP can be created by wear of orthopedic joint replacements

Schematic of exposure setup



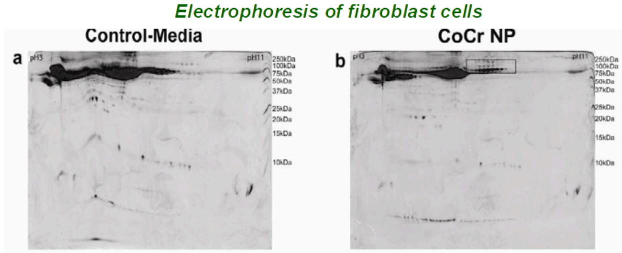
The indirect effect of CoCr nanoparticles on human fibroblasts cells was evaluated. The fibroblast cells were protected by a cell barrier made out of BeWo (a human choriocarcinoma). The set up models the protein transport through placenta and similar barriers

Nature nanotechnology (2009) 4, 873

DNA Damage of Cobalt-Chromium NP

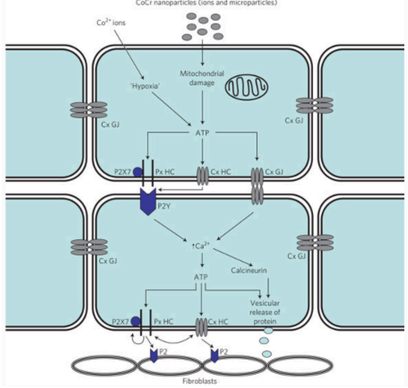
➢ Despite the presence of the cell barrier the cell underneath were affected by the presence of the metallic nanoparticles as determined by various methods

Electrophoresis of fibroblast cells



Electrophoresis results reveal DNA damage of the fibroblast cells, as revealed by the difference e in the bands of the control hydrogel and the one corresponding to the assay with CoCr NP. Other functions were also affected such as the frequency of mitosis

Nature nanotechnology (2009) 4, 873



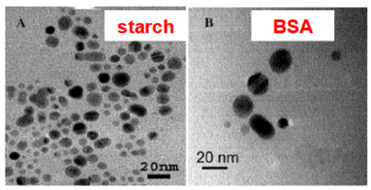
The DNA damage of the cells below the barrier occurs through a chain of events starting with the damage of the mitochondria in the top layer of the cell barrier which end up in secretion of ATP from the bottom layer to the fibroblasts

Nature nanotechnology (2009) 4, 873

Silver Nanoparticles Toxicity

➢ The toxicity of silver nanoparticles was tested using embryos of zebra fish

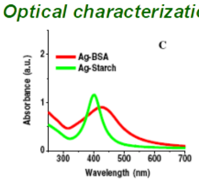
TEM images of Ag Nanoparticles



Two kind of nanoparticles were used. One capped with BSA and the other one with starch

The coating of the nanoparticle confer them the desired solubility and stability properties in water

Optical characterization



Extent of toxicity is to be measure in term of mortality rate, hatching, heart rate and abnormal phenotypes

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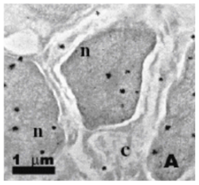
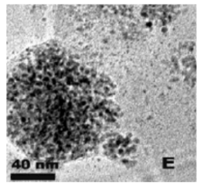
trespass the embryo barrier and settle inside, thus causing the effects to be observed

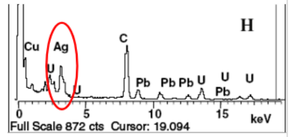
TEM Mitochondria



TEM Nucleus



EDS of embryo



Nuclear deposition is believed to create a cascade of toxic events leading to DNA damage and similar ones

It is possible that the nanoparticles may enter the cells through many routes. Among them, endocytosis through the embryo wall is more likely

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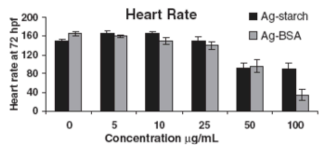
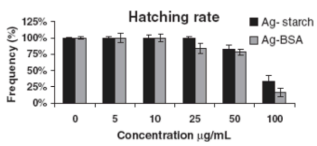
Silver Nanoparticles Toxicity

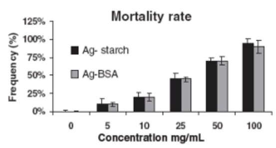
Toxicity End Points



Toxicity end points reveal a concentration-dependent occurrence of negative events such as death



Nanoparticle deposition in the central nervous system could have adverse effects in the control of cardiac rhythm, respiration and body movements



Exposure to silver nanoparticles resulted as well in accumulation of blood causing edema and necrosis

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Conclusions

Past and Current Work

- Almost without exception, every single study of nanoparticle toxicology issues a warning to the exposure to all the various nanoparticles until more conclusive studies can be made

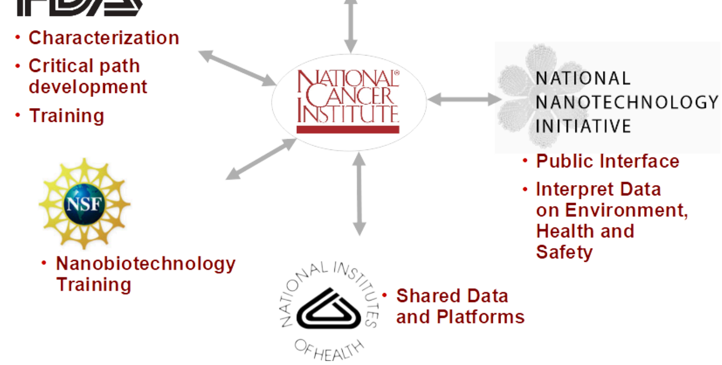
- There exists reports establishing guidelines and ground rules for nanotechnology research. These have been issued by governmental agencies worldwide. However, these norms are advisory, not mandatory

- There has to be compromise between testing all the possible scenarios for each nanoparticles, and creation of standards to unify tests

- Nanotechnology is a double-edge sword, the same novel properties making nanoparticles attractive, makes them potentially toxic. Particular care must be taken in nanomedicine, since in this area is where greater exposure would be present

(https://web.archive.org/web/20100619234814/http://www.che.tamu.edu/orgs/groups/Seminario/nanotechnology/PLong_G4_Nanotoxicology_Diego_Gomez.ppt)

https://web.archive.org/web/20090712082036/http://www.fda.gov/downloads/ScienceResearch/SpecialTopics/Nanotechnology/NanotechnologyTaskForce/ucm1113



https://web.archive.org/web/20051031223004/http://www.fda.gov/nanotechnology/ILSI-HESI-ann-mtg-pres-1-17-05.ppt

FDA Perspective on Nanomaterial-Containing Products

Nakissa Sadrieh, Ph.D.

Associate Director for Research Policy and Implementation

Office of Pharmaceutical Science, CDER, FDA

Nanotechnology

- Drugs
- Drug delivery systems
- Medical devices
- Vaccines
- Biotechnology products
- Cosmetics
- Gene and protein delivery
- Combination tissue/device

General Concerns about Nanotechnology Products

- Examples of concerns regarding:
  - Safety
  - Quality of material/characterization
  - Environmental

- What are the differences in the ADME profile of nanoparticles versus larger particles?
- What preclinical screening tests would be useful to identify potential risks (in vitro or in vivo)?
- Can new technologies such as "omics" help identify potential toxicities and how can these methodologies complement current testing requirements?
- Can nanoparticles gain access to the systemic circulation from dermal exposure? If nanoparticles enter skin cells, is there an effect on cellular functions? This would be relevant to drugs and cosmetics.

Environmental Concerns

- Can nanoparticles be released into the environment following human and animal use?
- What methodologies would identify the nature, and quantify the extent, of nanoparticle release in the environment?
- What might be the environmental impact on other species (animals, fish, plants, microorganisms)?

Is there any doubt our enemies would exploit nanotechnology against civilization were they able to?

Threats – Military

- Nanotechnology is being explored for potential military applications.
- It is cheap, easy to reproduce, and possibly remarkably useful in both armor and weapons.

Kim Jong Il – Leader of N. Korea

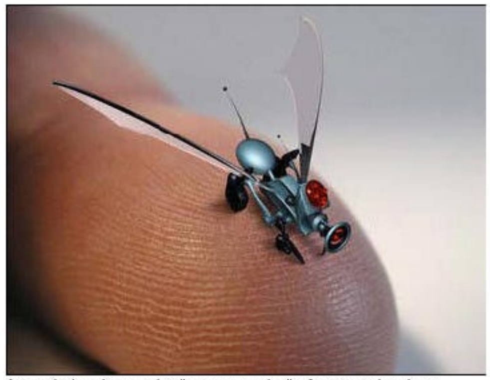
Nanoassemblers

The "Holy Grail of Nanotechnology"

Self-copying nanobots

At the *NYTimes*, A Frame Shift for Nanotech?

Category: **FRAME: Pandora's Box** ▪ **Issue Attention Cycles** ▪ **Nanotechnology**
Posted on: May 22, 2008 1:34 PM, by **Matthew C. Nisbet**



An artist's take on the "scary wonder" of nanotechnology.

NASA's Light-Sailing, Miniature, Nanotechnology-Based Spacecraft Artificial Intelligence Management Patent Application

By Bill Slawski, on April 1st, 2007

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CARLO MONTEMAGNO is planning an invasion of your body. "We want to make machines we can insert inside cells," he says. Once they're in there, he aims to make them do things that nature simply can't, such as make drugs or generate electricity.

Nanoelectronics combine biology, chemistry, physics, engineering, and computer science, i.a. computer chi (nanochips), nanomotors, nanoelectronics to body's nervous system

Potential Danger

- Miniature Weapons and Explosives
- Disassembles for Military Use
- Uncontrolled Nanomachines
- Self Replicating Nanomachines
- Monitoring
- Tracking

Intentional misuse of the technology as an act of war or terrorism will be difficult to contro

…

https://environmentjournal.online/features/nanoparticles-pose-major-threat-to-our-environment-scientists-warn/

Health Risks

The small size of nanoparticles allows them to penetrate biological barriers, such as cell membranes and the blood-brain barrier, potentially **causing harm to living** example, some nanoparticles have been shown **to cause inflammation and damage to the lungs when inhaled.** There is also concern that nanoparticles **may accumulate cause long-term health effects.**

https://web.archive.org/web/20060427164615/http://www.voyle.net/Nano%20Debate%202005/Nano%20Debat 0040.htm

Vanderbilt chemical engineers question safety of certain nanomaterials

A new study published in December 2005 in Biophysical Journal raises **a red flag regarding the safety of buckyballs when dissolved in water**. It reports the results of a det simulation that finds **buckyballs bind to the spirals in DNA molecules in an aqueous environment, causing the DNA to deform, potentially interfering with its biologic possibly causing long-term negative side effects in people and other living organisms**.

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The research, conducted at Vanderbilt by chemical engineers Peter T. Cummings and Alberto Striolo (now a faculty member at the University of Oklahoma), along with Oak Rid Laboratory scientist Xiongce Zhao, employed molecular dynamics simulations to investigate the question of whether buckyballs would bind to DNA and, if so, might inflict any la

"Safe is a difficult word to define, since few substances that can be ingested into the human body are completely safe," points out Cummings, who is the John R. Hall Chemical Engineering and director of the Nanomaterials Theory Institute at Oak Ridge National Laboratory.

Surprising findings

Despite the caveat, Cummings suggests that his research reveals a potentially serious problem:

"Buckyballs have a potentially adverse effect on the structure, stability and biological functions of DNA m Cummings' team found that, depending on the form the DNA takes, *the 60-carbon-atom (C60) buckyball m can lodge in the end of a DNA molecule and break apart important hydrogen bonds within the double helix.*

Cummings' team found that, depending on the form the DNA takes, the 60-carbon-atom (C60) buckyball molecule can lodge in the end of a DNA molecule and break apart important hydrogen bonds within the double helix. They can also stick to the minor grooves on the outside of DNA, causing the DNA molecule to bend significantly to one side. Damage to the DNA molecule is even more pronounced when the molecule is split into two helices, as it does when cells are dividing or when the genes are being accessed to produce proteins needed by the cell.

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now are experimental and theoretical studies to demonstrate whether they can actually get there. Because toxicity of nanomaterials like buckyballs is not well known at this point, they are regarded in the laborator *potentially very hazardous*, and treated accordingly.”

Environment: Dangers

- “Activists caution that nanoparticles are small enough to enter the lungs or be absorbed through the skin. As a result, they could accumulate in the food chain and kill ecologically important organisms and adversely affect human health, too” (Jennifer Bails. January 21, 2005 Friday. Nanotechnology is next big thing in electronics and manufacturing. *Pittsburgh Tribune Review*.)
- “In a study run by Anna A. Shvedova, an adjunct associate professor at West Virginia and a senior staff scientist at the institute, the researchers put carbon nanotubes into the lungs of mice and found scar tissue forming within a week, faster than the scarring from any other material they have tested.” (Richard Monastersky. September 10, 2004, Friday, The Dark Side of Small, *The Chronicle of Higher Education*)

https://www.sciencedirect.com/science/article/pii/S2405844024074243 Nano Revolution: “Tiny tech, big impact: How nanotechnology is driving SDGs progress” –

Fig. 1. **UN Sustainable Development Goals and Nanotechnology** (no poverty; zero hunger; good health and well-being; quality education; gender equality; clean water and s affordable and clean energy; decent work and economic growth; industry, innovation and infrastructure; reduced inequalities; sustainable cities and communities; responsible co production; climate action; life below water; life on land; peace, justice, and strong institutions; and partnerships for the goals).

Paragraph 70 of the 2030 Agenda reads: ***"The Technology Facilitation Mechanism will be based on a multi-s collaboration between Member States, civil society, private sector, the scientific community, United Nations en other stakeholders and will be composed of a United Nations Interagency Task Team on Science, Technology, Innovation for the SDGs, a collaborative Multistakeholder Forum on Science, Technology, and Innovation fo and an on-line platform."***

1.2. Nanotechnology

To achieve these 17 goals, it is time to recognize the crucial role of science and technology in tackling and solving the current challenges addressed by these goals.

As an emerging technology, nanotechnology (the science and technology at the atomic level) has the potential to significantly contribute to achieving these goals, since it will deliver disruptive, game-changing discoveries and innovations that benefit our society, environment, and planet.

Nanotechnology, the science of altering matter on an atomic scale (10^{-9} m), has evolved rapidly in recent years as a result of its prospective applications in disciplines such as medicine, electronics, and energy. It all started with Richard Feynman [1], a physicist, who initially presented the concept of nanotechnology in his famous lecture "There's Plenty of Room at the Bottom" in 1959. In this lecture, Feynman highlighted the prospect of manipulating and directing individual atoms and molecules to build new materials and gadgets. This was followed in 1974 by Norio Taniguchi [2], a Japanese physicist, who coined the word "nanotechnology" in a paper

	mechanical properties [22–31]. (Fig. 3)	
2D nanostructures (Nanowalls, Nanosheets, thin films)	Two-dimensional (2D) nanostructures are materials or structures that have a thickness or height of only a few atomic or molecular layers, while their other dimensions can extend to macroscopic scales. These nanostructures possess unique properties and behaviors due to their reduced dimensionality. In a two-dimensional nanostructure, the atoms or molecules are arranged in a specific pattern within the two-dimensional plane. This arrangement can be regular, such as in a crystal lattice, or irregular, depending on the material and fabrication method. One of the most well-known examples of a two-dimensional nanostructure is graphene. Graphene is composed of a single layer of carbon atoms arranged in a hexagonal lattice. It is an excellent conductor of electricity and heat and possesses exceptional mechanical strength [32–38].(Fig. 4)	Batteries, supercapacitors, sensors, tissue engineering, energy conversion, membranes, water purification, self-cleaning and self-healing surfaces, sanitation, coatings, drug delivery, Electronic devices, and sensors

2. Nanotechnology and the 17 SDGs

Nanotechnology is now an interdisciplinary field bringing together researchers from physics, chemistry, biology, engineering, and materials science to transform numerous industries and open up new avenues for innovation and discovery, thus developing communication, negotiation, problem-solving, analytical thinking, and many other soft skills. Through the development of smart materials and connected devices, Nano is making an impact in different sectors such as energy, environmental protection, resource management, and healthcare. Summarized applications of different nanostructures are presented in Table 2....

Thus, by drawing inspiration from natural systems and working at the atomic level, scientists can achieve the UN 17 Sustainable Development Goals. Nanotechnology is diverse and holds great potential for solving real-world challenges [40] and transforming many parts of human life.

It is important to note that these 17 goals are interrelated (Fig. 5), and achieving one will result in achieving the others. The world's utmost goal is to bring about world peace, which can be achieved by fostering prosperity (by achieving no poverty and economic growth goals), which is based on supporting people and building their capacity (by achieving Zero hunger, quality of education, gender equality, reducing inequality, and good health goals). People and capacity building is based on protecting the planet and building the infrastructure (by achieving clean water, clean energy, life on land, life underwater, consumption and production, as well as building sustainable cities and addressing climate change issues goals). Gathering well-experienced people, establishing national and international partnerships, and working on innovative solutions using science and technology to meet all the above-mentioned goals can be achieved.

PROTECTING THE PLANET!!!!!!!

WHAT A JOKE!!!

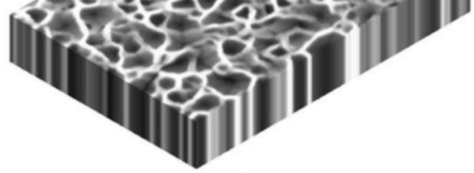


Fig. 4. Illustration of two-Dimensional Nanostructures [39].

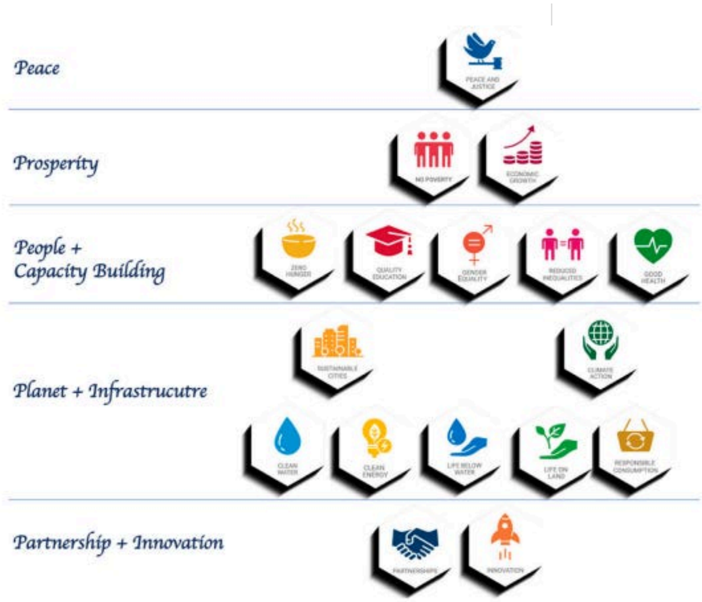


Fig. 5. Interlinked SDGs.

2.1. Partnerships for the goals (Goal 17)

- European Union's Horizon 2020 Program: The Horizon 2020 program has funded various nanotechnology-related projects involving collaboration between multiple European countries. Examples include the Graphene Flagship project, which focuses on developing graphene-based technologies.
- International Nanotechnology Laboratory (INL): The INL, based in Portugal, is an international research organization that collaborates with multiple countries to advance nanotechnology research. It serves as a hub for interdisciplinary research and innovation.
- Global Nanotechnology Network (GNN): The GNN facilitates collaboration among researchers and institutions worldwide. It supports projects that aim to address global challenges through nanotechnology, fostering international cooperation.

2.4. Affordable and clean energy (Goal 7)

Nanotechnology can potentially improve the efficiency and cost-effectiveness of renewable energy sources, such as solar cells [30, 37,65,66] (using Zinc oxide Nanowires, and Quantum dots as illustrated in Figs. 8 and 9) and fuel cells [67,68]. Furthermore, nanomaterials can be employed to develop more efficient and durable versions of energy storage devices, such as batteries [34,69–71] and capacitors [37,72–74](using Nanowalls - Fig. 10). Researchers are working today on printed and flexible solar cells, as well as batteries. Nanotechnology can also enhance the energy efficiency of buildings, vehicles, and manufacturing processes, reducing energy consumption and greenhouse gas emissions. In addition, nanotechnology-based sensors [38,75–77] can be used to monitor energy usage in real-time, improving the efficiency of energy distribution systems. Finally, it can be used to create off-grid renewable energy solutions that supply electricity to remote areas lacking access to conventional power networks.

Three US-based solar cell start-ups (Nanosolar, Nanosys, and Konarka Technologies) and corporate players, including Matsushita and STMicroelectronics, are striving to produce photon-harvesting materials at lower costs and in higher volumes than traditional crystalline silicon photovoltaic cells.[2] Nanosys intends its solar coatings to be sprayed onto roofing tiles. And Konarka is developing plastic sheets embedded with titanium dioxide nanocrystals coated with light-absorbing dyes. The company acquired Siemens' organic photovoltaic research activities, and Konarka's recent $18 million third round of funding included the world's first- and fifth-largest energy companies, Electricité de France, and ChevronTexaco. If nanotech solar fabrics could be applied to, e.g., buildings and bridges, the energy landscape could change in significant ways. Integrated into the roof of a bus or truck, they could split water via electrolysis and generate hydrogen to run a fuel cell.

2.5. Sustainable cities and communities (Goal 11)

By using nano-coatings on windows to improve insulation and lower energy consumption, nanotechnology can be utilized to increase a building's energy efficiency [52] and decrease its environmental impact. Furthermore, cities can have access to clean, safe water thanks to nanotechnology-based water treatment technologies that increase the effectiveness of water treatment facilities and lessen the environmental impact of wastewater discharge. Air pollution [56,78] can be reduced in metropolitan areas by using air filters based on nanotechnology. Also, real-time infrastructure monitoring using nanotechnology-based sensors can help cities and populated areas be more resilient to natural catastrophes by seeing possible problems before they become serious. Lastly, urban transportation [33,79–83] networks can be improved with the use of nanotechnology (self-healing nano coatings, graphene for lighter and stronger vehicles' bodies, carbon-nanotubes bumper, and many others). Regarding Construction and buildings [41–43,45], nanotechnology can create self-healing building materials, and improve insulation, coatings, and energy production. Concrete can patch gaps, resulting in more durable infrastructure and less maintenance. Nanoparticles can enhance thermal conductivity, increase energy efficiency, and enhance durability. Building-integrated photovoltaics (BIPV) can produce renewable energy on-site, reducing energy consumption in buildings. Mexico City faced significant air pollution issues. Nano-enabled coatings on buildings and roads, incorporating titanium dioxide nanoparticles [84], reduced air pollution by breaking down pollutants.[3] This technology led to improved air quality, respiratory health, and a more sustainable urban environment, contributing to the goal of sustainable cities and communities.

2.6. Responsible consumption and production (Goal 12)

Nanomaterials can be employed to develop more durable and longer-lasting products [85], reducing waste generated by consumer goods. Furthermore, nanomaterials will help in developing more efficient recycling [44,45,55] processes, improving the sustainability of waste [53,55,86] management. Nanotechnology can make manufacturing processes more energy efficient, reducing energy consumption and greenhouse gas emissions. In addition, nanotechnology-based agricultural [87–90] technologies can improve crop yields [91–94] and reduce environmental impacts, promoting sustainable agriculture practices. Furthermore, nanotechnology-based water treatment technologies can improve the efficiency of water treatment plants and reduce the environmental impact of wastewater discharge.

2.7. Climate action (Goal 13)

Tackling climate change and environmental challenges is a critical issue today; setting ambitious goals, such as zero pollution approaches for a toxin-free environment, is a big challenge by itself. Major investment in cutting-edge technology and research has been considered where Nano plays a critical role in achieving these transformative obviatives. By using nanotechnology, renewable energy sources (Goal 7), like solar cells and fuel cells, can be made more effective and affordable, and versions of energy storage devices like batteries and capacitors can be made stronger and more effective. Furthermore, carbon dioxide emissions [38,95,96] from industrial operations can be captured and stored using nano-based materials, which lowers greenhouse gas emissions [97–99], using Nano-Zeolite, which can be achieved by increasing the energy efficiency of structures, transportation, and manufacturing techniques. Additionally, nanosensors can be used to continuously monitor environmental [53,56,60,83,100–102] conditions, spotting potential problems before they become serious and assisting in reducing the effects of climate change on ecosystems.

Tesla, a leader in electric vehicle manufacturing, utilizes nanotechnology in its battery technology. By using silicon nanowires in lithium-ion batteries [103], Tesla increased energy storage capacity and extended the driving range of electric vehicles. This innovation not only promotes clean energy but also reduces greenhouse gas emissions, supporting climate action.

Scientists at the Lawrence Berkeley National Laboratory, a part of the U.S. Department of Energy, have crafted an advanced carbon capture membrane with exceptional permeability. This innovation holds the potential to enhance the efficiency of isolating carbon dioxide from power plant emissions. By preventing the release of this greenhouse gas into the atmosphere, the membrane offers a promising avenue for mitigating climate change. The researchers concentrated their efforts on developing a hybrid membrane comprising both polymer and metal-organic framework components. The latter is a porous three-dimensional crystal renowned for its extensive internal surface area, capable of absorbing significant quantities of molecules.

Concrete, renowned for its strength and cost-effectiveness, stands as the ideal construction material. However, its durability

explicitly for cloud seeding, these nanomaterials prove superior to conventional agents like salt and dry ice precision and efficacy make them a more advanced tool for inducing rainfall from existing clouds.

2.8. Life below water (Goal 14)

In order to conserve and utilize ocean, sea, and marine resources sustainably, nanotechnology can help water bodies be effectively cleaned of pollutants [60], like heavy metals and organic compounds, by using nanoparticles. Additionally, nanotechnology-based sensors can accurately detect and monitor water pollution levels. In terms of oil spill cleanup [106–109], nanotechnology provides innovative solutions. Nanostructured materials like graphene-based sorbents or nanofibers can effectively absorb oil from water surfaces due to their high surface area-to-volume ratios. Desalination [61–64] is another area where nanotechnology plays a crucial role. Nanomaterials such as graphene oxide membranes or carbon nanotubes can selectively filter out salt ions from seawater, making it suitable for drinking and irrigation. Nanotechnology also contributes to marine biotechnology by enhancing drug delivery [110] systems for marine organisms. Nanoparticles can be designed to deliver therapeutic agents precisely to target cells or tissues in marine organisms, aiding in disease treatment and conservation efforts. To protect coral reefs [111], nanotechnology-based coatings can prevent the settlement of harmful organisms like algae or bacteria on their surfaces. These coatings [112] can also provide a controlled release of nutrients to promote coral growth. Nanosensors and nanodevices enable real-time monitoring of marine ecosystems by detecting changes in water quality, temperature, pH levels, and the presence of harmful substances. This data helps in the early detection of environmental issues and facilitates timely interventions. In terms of sustainable fishing practices [113], nanotechnology offers the development of nanoscale sensors to monitor fish populations, track migration patterns, and assess the impact of fishing activities on marine ecosystems. This information guides policymakers in implementing effective fisheries management strategies.

2.9. Life on land (Goal 15)

Nanomaterials can be used to remediate contaminated soils [56,114,115], improving soil quality and promoting plant growth. Furthermore, nanosensors can be used to monitor soil moisture levels, nutrient content, and other environmental factors in real time, improving the efficiency and sustainability of agricultural practices. Nanotechnology-based sensors can be used to monitor forest health and detect potential issues before they become critical, improving forest management practices and preventing deforestation [101]. In addition, nanotechnology-based materials can be used to develop new conservation technologies that protect endangered species and promote biodiversity [116]. It is also good to mention that nanotechnology-based materials can be used to restore degraded lands by improving soil quality and promoting plant growth.

The Fontagro[4] project seeks to use nanotechnology (nanoclays and hydrogels) to help improve the moisture retention capacity of soils, increasing agricultural productivity in areas undergoing desertification and/or drought. Both materials will be developed in Ecuador by scientists from Yachay Tech University (UYT), evaluated under controlled conditions by INIAP (Ecuador), evaluated and validated in a participatory manner in real field conditions in four crops (potato, quinoa, corn, and wheat) by PROINPA (Bolivia) and by INIAP. The project strategy is based on developing and using nanoclays and hydrogels. Nanoclays have very small particles with a large contact and expansion surface. Hydrogels are manufactured from cellulose fibers obtained from agricultural waste and are inexpensive. Both materials have the ability to retain large volumes of water and have a low environmental impact, ideal for agricultural applications. After being developed in the laboratory, these products will be incorporated into degraded soils to see their effect on water retention, increasing microbial diversity, and improving agricultural productivity.

In Thailand, scientists at Chiang Mai University's nuclear physics laboratory have rearranged the DNA of rice by drilling a nano-sized hole through the rice cell's wall and membrane and inserting a nitrogen atom. So far, they've been able to change the color of the grain from purple to green. [5]

Monsanto, Syngenta, and BASF are developing pesticides enclosed in nanocapsules or made up of nanoparticles. The pesticides can be more easily taken up by plants if they're in nanoparticle form; they can also be programmed to be "time released." [117].

With funding from the US Department of Agriculture (USDA), Clemson University researchers are feeding chickens bioactive polystyrene nanoparticles that bind with bacteria as an alternative to chemical antibiotics in industrial chicken production.

"Little Brother": The USDA is pursuing a project to cover farmers' fields and herds with small wireless sensors to replace farm labor and expertise with a ubiquitous surveillance system.

Once the **above-mentioned goals** have been achieved, this would pave the way to the following goals.

2.10. Zero hunger (Goal 2)

Sustainability is an essential driver for the agriculture and food sector, as it is crucial to feed all population with optimized health and nutritious produced food. Today's food sector can benefit significantly from Nanotechnology by achieving food security, improving nutrition, and promoting sustainable agriculture. By using nanoparticles to distribute nutrients [116,118–120] directly to plant roots and nanosensors to detect nutrient deficits in soil, new agricultural technologies [87–90,121–124] can be created to boost crop yields and decrease waste (Goal 15). Furthermore, by incorporating silver, titanium dioxide, silver, gold, copper, and cadmium sulfide nanoparticles into packaging materials to provide a barrier against oxygen and moisture, nanotechnology can be used to build novel food packaging [125–129] materials that prolong food's shelf life and lower spoilage. Also, by using nanosensors to continuously monitor soil moisture levels, new water management technologies can be created that increase irrigation effectiveness and decrease water waste.

In Kenya, nanotechnology has been applied to improve soil quality. Nano-encapsulated fertilizer, slowly releasing nutrients to crops, enhanced crop yields by up to 30 %. This increased food production contributed to food security and improved income for local farmers, addressing both hunger and poverty.

Scientists from the University of Wisconsin have successfully used single bacterial cells to make tiny bio-electronic circuits, which could, in the future, be used to detect bacteria, toxins, and proteins[6]the medical nanotechnology market is anticipated to achieve a value.

Kraft, Nestlé, Unilever, and others are employing nanotech to change the structure of food – creating "interactive" drinks containing nanocapsules that can change color and flavor (Kraft) and spreads and ice creams with nanoparticle emulsions (Unilever, Nestlé) to improve texture. Others are inventing small nanocapsules that will smuggle nutrients and flavors into the body (what one company calls "nanoceuticals").

BASF, Kraft, and others are developing new nanomaterials that extend food shelf life and signal when food spoils by changing color.

access to affordable and hygienic [163,164] menstrual products hinders young girls' education and women's participation in society. Nanofiber-based materials can be used to develop highly absorbent and biodegradable sanitary pads [165] that are more comfortable and environmentally friendly than traditional options. Additionally, nanotechnology can be employed to create antimicrobial coatings for reusable menstrual cups, reducing the risk of infections. Another area where nanotechnology can contribute to gender equality is agriculture. Women play a vital role in agricultural production, particularly in developing countries. However, they often face numerous challenges, such as limited access to resources, climate change [91] impacts, and post-harvest losses. Nanotechnology can address these challenges by improving crop yields [91–94], enhancing soil fertility with nano-fertilizer (NH^{4+}-N), which recorded lower N_2O emission (1.8 mg $m^{-2}day^{-1}$) than conventional fertilizer (2.7 mg $m^{-2}day^{-1}$) as well as using Zinc Oxide, Silicon dioxide, Titanium dioxide, and many others, as well as developing efficient pest control [166–169] methods using metal oxide nanomaterials.

Furthermore, nanosensors can monitor soil moisture and nutrient levels, enabling precise irrigation and fertilizer application. This can empower women farmers by increasing their productivity and income. In the energy field, nanotechnology can contribute to gender equality by promoting access to clean and affordable energy sources. In many developing countries, women and girls are burdened with collecting firewood or using inefficient cooking methods, which negatively impacts their health and well-being. Nanotechnology-based solutions such as solar cells, energy storage devices, and efficient lighting systems can provide sustainable energy alternatives. By reducing the time spent on energy-related chores, women and girls can have more opportunities for education, economic empowerment, and personal development.

2.14. *Reduced inequalities (Goal 10)*

Reducing inequalities is a crucial goal for sustainable development, as it aims to ensure that everyone has equal access to resources, opportunities, and essential services. Nanotechnology, with its unique properties and applications, has the potential to contribute significantly to reducing Inequalities. One area where nanotechnology can make a difference is in healthcare [163,164]. Access to quality healthcare is often limited in remote or underserved areas, leading to health disparities and inequalities. Nanotechnology-based medical devices and diagnostic tools can help bridge this gap by providing affordable and portable solutions. For example, nanosensors can be used for rapid and accurate disease detection, enabling early intervention, and reducing healthcare disparities. Nanoparticles can also be utilized for targeted drug delivery, increasing the effectiveness of treatments while minimizing side effects.

Furthermore, nanotechnology can contribute to reducing inequalities in access to clean water [54,56,58] and sanitation. In many parts of the world, lack of access to safe drinking water and proper sanitation facilities leads to health problems and perpetuates poverty. Nanomaterials can be employed to develop efficient water purification systems that remove contaminants and pathogens effectively. Nanostructured membranes can enhance water filtration processes, making clean drinking water more accessible in resource-limited settings. Additionally, nanotechnology can enable the development of self-cleaning surfaces [9,170] and antimicrobial [164,171] coatings for sanitation facilities using nano ZnO and carbon nanotubes, improving hygiene standards. Education [153,154,156] is another area where nanotechnology can help reduce inequalities. Access to quality education is often limited in disadvantaged communities due to various factors, such as lack of resources or qualified teachers. Nanotechnology-based educational tools and materials can provide interactive learning experiences that are engaging and accessible to all students. For instance, nanoscale models or simulations can be used to visualize complex scientific concepts, making them easier to understand. Nanotechnology can also contribute to developing low-cost educational devices and platforms, enabling remote learning opportunities for underserved populations. In the energy field [29,30,52,65,66], nanotechnology can help reduce inequalities by promoting access to clean and affordable energy sources. Many developing regions still rely on fossil fuels or inefficient energy systems, which disproportionately affect marginalized communities. Nanotechnology-based solutions such as solar cells, energy storage devices, and energy-efficient materials can provide sustainable alternatives. By decentralizing energy production and reducing reliance on centralized grids, nanotechnology can empower communities to generate their own clean energy and reduce energy poverty.

2.15. *No poverty (Goal 1)*

By developing new, more affordable, green, and effective materials and devices than those produced by present technologies to be applied in construction and building in energy conversion and energy storage, in health, water treatment, and agriculture, nanotechnology can aid in the fight against poverty. Thus, by transferring these technologies to those countries facing high levels of poverty, identifying, and using their existing raw materials, establishing factories, and creating new job opportunities, the poverty level can be decreased.

In India, poverty is intertwined with inadequate access to clean drinking water. Nanotechnology was employed to develop low-cost water filters with silver nanoparticles. These filters effectively remove bacteria and impurities, providing safe drinking water. As a result, impoverished communities experienced reduced waterborne diseases, improved health, and lower medical expenses, contributing to poverty reduction.

The University of Toronto Joint Center for Bioethics (UTJCB) has consistently engaged the academic community by presenting a map illustrating various governmental nanotechnology initiatives. This map underscores the inclination of numerous developing countries to promote these technologies. Highlighting the potential of several nanotechnologies to ameliorate impoverished living conditions, it is observed that developing countries are actively pursuing nanotech initiatives. The UTJCB suggests the necessity of establishing an international network to evaluate emerging technologies geared toward development. China, South Korea, and India are recognized as leaders, while Thailand, the Philippines, South Africa, Brazil, and Chile fall within the intermediate category.

The Achievement of all the previous goals will promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.

2.17. Peace, justice, and strong institutions (Goal 16)

Nanotechnology, with its unique capabilities and applications, can play a significant role in advancing peace [175]. Forensic investigations are crucial in ensuring justice and maintaining law and order. Nanotechnology-based techniques can enhance forensic analysis [176–178] by providing more accurate and efficient evidence collection and analysis methods. For example, nanosensors can detect trace amounts of substances such as drugs or explosives, enabling faster and more precise identification. Nanoparticles can also be employed as contrast agents in imaging techniques, improving the visualization of evidence such as fingerprints or DNA samples.

Furthermore, nanotechnology can aid in strengthening institutions through improved security measures [179–181]. Nanomaterials can be utilized to develop advanced security systems with enhanced threat detection and prevention capabilities. For instance, nanoscale sensors integrated into surveillance systems can detect abnormal activities or hazardous substances in real time, enhancing

Nanotechnology-based encryption methods can also improve data security and protect sensitive informati contributing to the establishment of robust institutional frameworks, especially in the era of quantum com

public safety. Nanotechnology-based encryption methods can also improve data security and protect sensitive information, contributing to the establishment of robust institutional frameworks, especially in the era of quantum computing. Nano is realizing stable qubits, thus leading to easy and rapid encryption and decryption of information and data analysis. Nanotechnology can also contribute to promoting peace by addressing environmental challenges [101]. Environmental degradation often leads to conflicts over resources such as water or land. Nanotechnology-based solutions can help mitigate these conflicts by providing sustainable alternatives. For example, nanomaterials can be used for efficient water purification or wastewater treatment, reducing the strain on freshwater resources. Nanotechnology-enabled sensors can monitor air quality, soil health, and water pollution, enabling early detection and prevention of environmental hazards. By promoting sustainable resource management, nanotechnology can contribute to peacebuilding efforts.

Additionally, nanotechnology can support access to justice by improving legal processes and enhancing forensic capabilities. Nanoscale materials can be used to develop advanced materials for evidence preservation, ensuring the integrity of collected samples. Nanotechnology-based techniques can also improve the analysis of complex legal documents or contracts, facilitating more efficient and accurate legal decision-making. Furthermore, nanotechnology can contribute to developing secure and tamper-proof identification systems, ensuring the authenticity of legal documents, and preventing identity theft or fraud. The Internet of Nanothings (IoNT) [181–183] is an emerging field that combines nanotechnology and the Internet of Things (IoT). It involves the integration of nanoscale devices, sensors, and systems into the IoT framework, enabling communication and data exchange at the nanoscale level. As nanodevices collect and transmit sensitive data, ensuring data integrity, confidentiality, and protection against cyber-attacks becomes crucial.

It is worth mentioning that during war and conflict, for early warning and threat detection, nanosensors [184–186] can detect chemical agents, explosives, biological threats, and other hazardous substances more accurately and rapidly than traditional sensors, enabling rapid response measures to protect people from potential dangers.

Nanocoating materials can effectively absorb or scatter radar waves [48,187,188], making items undetectable by radar and, thus, improving stealth capabilities (such as Ghost ships, and ghost airplanes).

By incorporating nanocapsules with healing agents, self-healing materials [20,79,189] can be fabricated and used to repair damage caused by impacts or wear and tear automatically.

During war and conflict, people face challenges adapting to these extreme environments. Nanofabricated clothing [190–192] can provide better insulation or cooling properties in extreme temperatures or protect against chemical or biological agents.

It is good to mention that researchers are now developing non-lethal weapons [193] that incapacitate or immobilize enemies without causing significant harm. This approach aims to minimize casualties and reduce the overall intensity of conflicts, potentially leading to more peaceful outcomes.

"We knew the world would not be the same. A few people laughed; a few people cried. Most people were silent. … … 'Now I am become Death, the destroyer of worlds.' I suppose we all thought that one way or another." said Robert Oppenheimer in 1965. It is important to note that while nanotechnology can contribute to peacebuilding efforts during the war, its effectiveness ultimately depends on the intentions and actions of those involved in the conflict. Ethical considerations and responsible deployment of nanotechnology are crucial to ensure its positive impact on establishing peace.

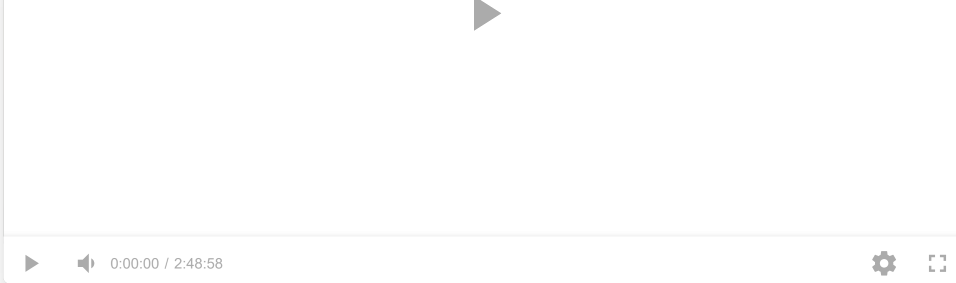
4. Challenges and risks associated with the use of nanotechnology serving the 17 SDGs

Nanotechnology holds great promise in addressing the UN SDGs by offering innovative solutions across its various sectors. However, this emerging technology, like any other, poses particular challenges and risks associated with the use of nanomaterials at the nanoscale. These challenges and risks can be categorized as follows.

1. **Health and environmental concerns** [207–215], coming from releasing nanomaterials, which have unique properties, into the environment can pose human and ecological risks (such as toxicity and bioaccumulation) and potential harm to ecosystems. Researchers and policymakers should collaborate to develop guidelines for the safe use and disposal of nanomaterials, ensuring minimal environmental impact. Implementing strict safety protocols in workplaces and conducting thorough toxicity assessments are crucial. Developing safer nanomaterials and responsible disposal practices can also help mitigate these risks. By mitigating these risks, we contribute to SDG2 (No Hunger) and SDG 3 (Good Health and Well-being), ensuring healthy lives and promoting well-being for all ages. Furthermore, efforts to minimize environmental impact align with SDG 6 (Clean Water and Sanitation), SDG7, SDG11, SG13, SDG14, and SDG 15 (Life on Land), contributing to the conservation of ecosystems and resources.

THESE PEOPLE ARE DANGEROUS MADMEN AND CRIMINALS.

destruction bequeathed to the nation states, on to a surprising and terrible empowerment of extreme individuals.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